# Driving Rate Effects On Crackling Response
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Examples of "Crackling" Response
- Earthquakes
- Magnetization of Disordered Materials (Barkhausen Noise)
- Acoustic Emission (Martensites)
- Superconducting Vortex Avalanches

Hysteresis Loop Detail

Magnetization M — External Field H
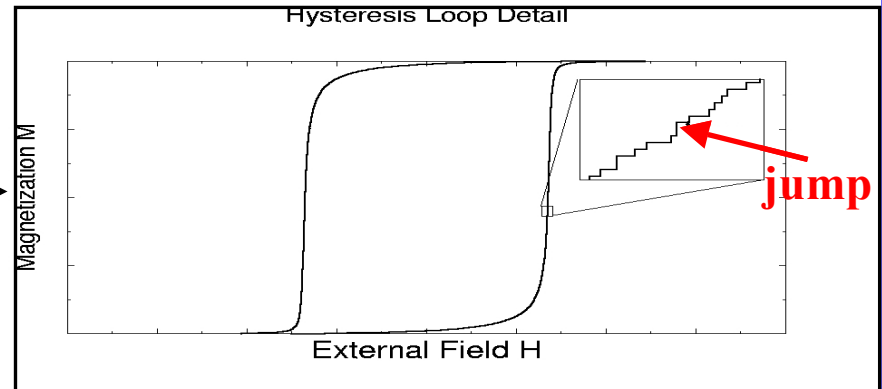
jump

Crackling? (at adiabatically slow driving)

Crackling systems have **universal** power law distributions of **jump** sizes and durations.

Adding a (small) Force Driving Rate Ω :

**Some systems ✹ No effect on jump size distributions
Others ✹ Exponents change linearly with driving rate**

(Important for theory, experiments, and applications)

Can be understood generally (see table next slide):
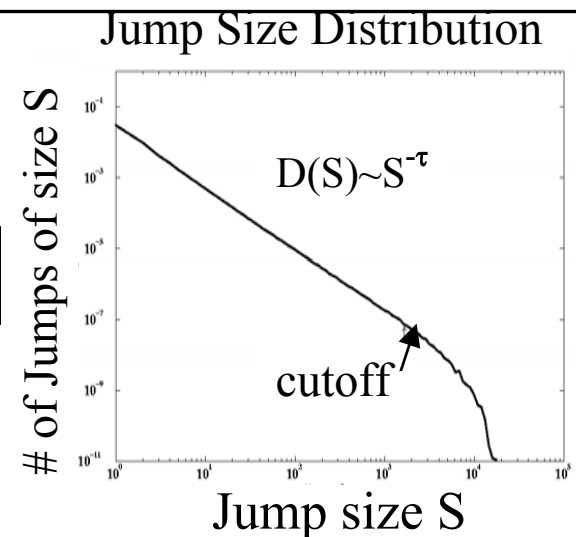
Jump Size Distribution

of Jumps of size S

$$D(S) \sim S^{-\tau}$$

cutoff

Jump size S

Spatial representation of jumps at

Driving Rate $\Omega=0$

And $\Omega>0$

No spatial overlap!

Table: General predictions for the driving rate effects, depending on the adiabatic value α_o of the universal exponent α (consistent with experiments on magnets).

Duration Distribution

$D(T)$ vs T

$T^{-\alpha}$

Models with

$\Omega=0$	$\Omega>0$	Experiments:
$\alpha_o < 2$	α unchanged	Durin, Zapperi
$\alpha_o = 2$	$\alpha(\Omega) = \alpha_o - c\Omega$	ABBM
$\alpha_o > 2$	α unchanged for large durations	